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Five-Year Review Report

Second Five-Year Review Report for Perham Arsenic Site Perham Otter Tail County, Minnesota

September 2006

PREPARED BY:

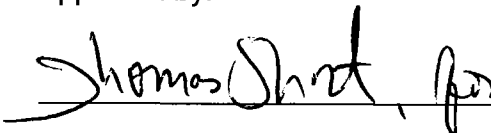
Minnesota Pollution Control Agency
525 S. Lake Avenue, Suite 400
Duluth, Minnesota 55802

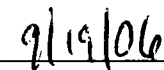
For:

United States Environmental Protection Agency
Region 5
Chicago, Illinois

Approved by:

Date:





Richard C. Karl
Director
Superfund Division, Region 5

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Acronyms

Agencies	MPCA and EPA	Pace	Pace Analytical Laboratories
ARARs	Applicable or Relevant and Appropriate Requirements	PLP	Permanent List of Priorities
		ppb	parts per billion
Bay West	Bay West, Inc.	ppm	parts per million
bgs	below ground surface	PRP	Potentially Responsible Party
CFR	Code of Federal Regulations	RA	Remedial Action
EPA	United States Environmental Protection Agency	RD	Remedial Design
		RI	Remedial Investigation
FS	Feasibility Study	RI/FS	Remedial Investigation/Feasibility Study
gpm	gallons per minute		
Hammers	Hammers Construction Company	ROD	Record of Decision
MCL	Maximum Contaminant Level	RFRA	Request for Response Action
MDH	Minnesota Department of Health	Site	Perham Arsenic Superfund Site
mg/kg	milligrams per kilogram	SRV	Soil Reference Value
MPCA	Minnesota Pollution Control Agency	SSC	State Superfund Contract
		TBC	To Be Considered
NCP	National Contingency Plan	μ g/L	micrograms per Liter
NPL	National Priorities List	Weston	Roy F. Weston, Inc.
O&M	Operation and Maintenance		

Executive Summary

The remedy for the Perham Arsenic Superfund Site (Site) in Perham, Minnesota, included excavation of the arsenic contaminated soil above 500 mg/kg and the installation and operation of a ground water recovery and treatment system for treating arsenic contaminated ground water. The remedy also included the municipal water supply hookup for a nearby resident, long term monitoring, and institutional controls.

Immediate threats have been addressed. The arsenic treatment system is operating and functioning as designed. An inward gradient has been established and the ground water plume has been successfully contained. In addition, on-going ground water monitoring has shown that arsenic concentrations have decreased at the plume boundaries.

The remedy at the Site is currently protective of human health and the environment. There is no evidence of current exposure to arsenic contaminated soil or groundwater. However, to ensure long-term protectiveness institutional controls restricting well drilling and soil exposure must be put in place.

Restrictive covenants for the properties containing areas of soil contamination will be implemented within the next year. The Minnesota Pollution Control Agency (MPCA) staff will continue to request that the Minnesota Department of Health (MDH) establish a Special Well Construction Area for preventing new wells from being drilled into the ground water plume. The MDH Commissioner has the sole statutory authority under Minnesota law to implement Special Well Construction Areas.

Long-term protectiveness of the remedy will be assured by continuing the long-term Operation and Maintenance (O&M) of the treatment system, by continuing long term monitoring to assure plume capture and by filing the restrictive covenants and Special Well Construction Area.

Five Year Review Summary Form

SITE IDENTIFICATION		
Site name (from WasteLAN): PERHAM ARSENIC SITE		
EPA ID (from WasteLAN): EPA ID# MND980609572		
Region: V	State: MN	City/County: Perham, Otter Tail
SITE STATUS		
NPL status: <input checked="" type="checkbox"/> Final <input type="checkbox"/> Deleted <input type="checkbox"/> Other (specify)		
Remediation status (choose all that apply): <input type="checkbox"/> Under Construction <input checked="" type="checkbox"/> Operating <input type="checkbox"/> Complete		
Multiple OUs?* <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		Construction completion date: 07/14/ 1998
Has site been put into reuse? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
REVIEW STATUS		
Lead agency: <input type="checkbox"/> EPA <input checked="" type="checkbox"/> State <input type="checkbox"/> Tribe <input type="checkbox"/> Other Federal Agency		
Author name: Susan Johnson and Barbara Gnabasik		
Author title: Project Leader and Site Hydrogeologist		Author affiliation: Minnesota Pollution Control Agency
Review period:** <u>12</u> / <u>20</u> / <u>2005</u> to <u>September</u> <u>2006</u>		
Date(s) of site inspection: <u>8</u> / <u>09</u> / <u>2006</u>		
Type of review: <input type="checkbox"/> Post-SARA <input type="checkbox"/> Pre-SARA <input type="checkbox"/> NPL-Removal only <input type="checkbox"/> Non-NPL Remedial Action Site <input checked="" type="checkbox"/> NPL State/Tribe-lead <input type="checkbox"/> Regional Discretion		
Review number: <input type="checkbox"/> 1 (first) <input checked="" type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify) _____		
Triggering action: <input type="checkbox"/> Actual RA Onsite Construction at OU # _____ <input type="checkbox"/> Actual RA Start at OU# <u>NA</u> <input type="checkbox"/> Construction Completion <input checked="" type="checkbox"/> Previous Five-Year Review Report <input type="checkbox"/> Other (specify) _____		
Triggering action date (from WasteLAN): <u>09</u> / <u>25</u> / <u>2001</u>		
Due date (five years after triggering action date): <u>09</u> / <u>25</u> / <u>2006</u>		

Issues:

Institutional controls including Site Deed Restriction required by the ROD and the Special Well Construction Area have not been implemented.

Recommendations and Follow-up Actions:

Establish institutional controls including Deed Restriction document required by the ROD and the Special Well Construction Area.

Protectiveness Statement:

The remedy at the Site is currently protective of human health and the environment. There is no evidence of current exposure to arsenic contaminated soil or groundwater. However, to ensure long-term protectiveness institutional controls restricting well drilling and soil exposure must be put in place.

Long-term protectiveness of the remedy will be assured by continuing the long-term Operation and Maintenance (O&M) of the treatment system, by continuing long term monitoring to assure plume capture and by filing the restrictive covenants and Special Well Construction Area.

Other Comments:

1.0 INTRODUCTION

The MPCA and the United States Environmental Protection Agency (EPA) Region 5 (collectively referred to as the Agencies) have conducted a five-year review of the RAs implemented at the Site, in Perham, Minnesota (Figure 1). The review was conducted between March 7, 2006 and September 2006. This report documents the results of the five year review.

The purpose of five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of the review are documented in this five-year review report. In addition, five-year review reports identify issues found during the review, if any, and make recommendations to address them.

This review is required by statute. The Agencies perform statutory reviews on remedies selected that result in hazardous substances, pollutants or contaminants remaining at a site above levels that allow for unlimited use and unrestricted exposure.

The National Contingency Plan (NCP) part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

This is the second five-year review for the Site. The first five-year review was completed on September 25, 2001. The date for the current five-year review is triggered by the completion of the first review. According to the first five-year review, the triggering action for the statutory review is the remedial action start date of September 30, 1996.

This five-year review and the corresponding supporting documents will become part of the Site record and are available for public review. The Site record is located at:

Minnesota Pollution Control Agency
525 S. Lake Avenue, Suite 400
Duluth, Minnesota 55802

and

Perham Public Library
225 2nd Ave. NE
Perham MN 56573

2.0 SITE CHRONOLOGY

Table 1. Chronology of Site Events	
Date	Event
1947	Lead arsenate and remaining grasshopper arsenic bait buried in Perham county fairgrounds.
1971	Hammers Construction Company (Hammers) purchases land from the City of Perham (parcel is area used for bait mixing and disposal)
May 1972	Drinking water well installed on Hammers property.
June 1972	Eleven Hammers employees become sick from drinking water from the well.
July 1972	Water samples collected for arsenic analysis from Hammers well, seven private wells within 120 to 1000-feet of the Hammers building, and three municipal wells within ½ mile of the Site.
July 1972	Hammers well is capped and the City water is extended to Hammers building.
August-October 1972	Minnesota Department of Agriculture collects soil samples at the suspected burial Site.
1974	Minnesota Department of Agriculture continues semi-annual monitoring of private and municipal wells within the Site's vicinity.
September 1980	EPA begins soil sampling and monitoring well installation.
1982	Burial pit is covered with a clay cap to reduce rain infiltration and leaching of arsenic to the ground water.
1983	MPCA issues a Request for Response Action (RFRA) and included the Site on the MPCA Permanent List of Priorities (PLP).
September 1984	Site is Final on the EPA National Priorities List (NPL).
1984	First Remedial Investigation/Feasibility Study (RI/FS) completed by the MPCA.
1985	MPCA performs soil excavation and installs impermeable membrane and clay cover over residual soil contamination.
September 1990	EPA conducts a Potentially Responsible Party (PRP) search.
1992/1993	EPA conducts two Phase Remedial Investigation (RI) and Feasibility Study (FS) because arsenic concentrations in the ground water did not significantly decrease subsequent to soil excavation.
February 1994	Proposed Plan released by EPA.
March 1994	EPA signs Record of Decision (ROD).
September 1994 – September 1996	EPA completes Remedial Design (RD).
September 1996	EPA starts Remedial Action (RA).
September 1996	State Superfund Contract (SSC) signed by EPA and MPCA.
September 1998	Pre-final inspection of the RA.
October 1998	Final inspection of the RA.
July 1999	MPCA takes over system operation and sampling of monitoring well network.
September 2001	Agencies complete first five year review.
September 2006	Agencies complete second five year review.

3.0 BACKGROUND

3.1 Physical Characteristics

The Site is located in the southwest corner of the East Otter Tail County Fairgrounds and on an adjacent parcel owned by Hammers Construction Company in Perham, Minnesota. The City of Perham is an agricultural-based village in north-western Minnesota. The population of Perham was estimated at 2,559 in the 2000 Census.

The topography around the Site is flat and gently slopes eastward toward the Otter Tail River, approximately 1.8 miles to the east. The Site surface consists largely of open, grassy fields and dirt roads. Several brick, wood and aluminum buildings exist on the Site (Figure 2). Subsurface features at the Site are characterized by a massive unit of glacial outwash sands and gravel. In the Perham vicinity, a confining clay unit is reported to exist within the glacial outwash. However, the confining clay unit was not encountered during RI activities performed at the Site. Ground water in the vicinity of the Site flows in an east to southeast direction towards Otter Tail River (Figure 3).

3.2 Land and Resource Use

The fairground properties are used for community and recreational purposes. The City of Perham uses four municipal wells to supply residential and commercial demands. Two wells are located in the southern section of the City limits, approximately ½ mile due west (hydraulically up gradient with respect to ground water flow) of the Site. Two additional municipal wells are located to the north, approximately ½ to ¾ miles from the Site. There are no changes to the municipal well system, which was not expected to influence the contaminant migration at the Site.

3.3 History of Contamination

During the grasshopper infestation of the 1930s and 1940s, the U.S. Department of Agriculture distributed lead arsenate to several counties in the State of Minnesota to be used as grasshopper bait. The bait was dispersed around farm fields to prevent crop loss. The southwest corner of East Otter Tail Fairgrounds was used as a mixing station and as a depository for pure (unmixed) lead arsenate and unused arsenic-based grasshopper bait. In 1947, pure lead arsenate and unused arsenic-based grasshopper bait were buried in a shallow pit in the southwest corner of the fairgrounds. Between 200 and 2,500 pounds of grasshopper bait containing over 50 pounds of technical grade lead arsenate is thought to have been buried in the pit in burlap bags, wood or other decomposable material. The shallow pit area, and associated ground water plume which emanated from the pit area and the infiltration gallery are considered the Site.

In 1971, Hammers Construction Company purchased property immediately adjacent to the southwest corner of the East Otter Tail County Fairgrounds and erected an office and a construction warehouse. In May 1972, a 31-foot deep, 1.25-inner diameter galvanized steel well was installed for Hammers. In June, eleven employees became sick as a result of drinking water from the well. Two of the employees suffered permanent effects.

3.4 Initial Response

In July 1972, water samples were collected for arsenic analysis from the Hammers well, seven private wells (within 120 to 1000-feet of the Hammers building), and three municipal wells that were located within ½ mile of the Site. The maximum concentration found in the Hammers well was 11,800 parts per billion (ppb). The Hammers well was capped and the City of Perham water was extended to the Hammers building. Between 1972 and 1982, sampling and Site characterization activities monitored private and municipal water and further defined the extent of buried arsenic. The investigation discovered that arsenic contaminated ground water extended approximately 600 feet down gradient (east) of the burial pit on the fairgrounds. Elevated levels of soil contamination were found in a 15 by 40 foot area just north of the Hammers property and well. In 1982, the burial pit was capped with a clay cover to reduce rain infiltration and leaching of arsenic to the ground water.

3.5 Basis for Taking Action

In 1983, the Site was included on the MPCA's PLP and on the EPA's NPL. In 1984, the MPCA completed the first RI/FS for the Site. In 1985, the MPCA implemented a RA that included the excavation and disposal of approximately 200 cubic yards of arsenic wastes and contaminated soils containing greater than 500 parts per million (ppm). Excavated soils were disposed of at an approved hazardous waste disposal facility. The 1985 remedy also included: (1) backfilling the excavated pit with clean fill; (2) re-establishment of the clay cap and installation of an impermeable membrane to minimize leaching of any residual arsenic; and (3) continuation of ground water monitoring. A ground water cleanup level of 50 ug/L (the federal drinking water Maximum Contaminant Level [MCL]) was established.

A PRP search was completed in December 1990. Considered in the PRP search were the U.S. Department of Agriculture, the State of Minnesota, the University of Minnesota, and the City of Perham. Enforcement information gathering activities followed. In March 1997, an Enforcement Closeout Memorandum was approved by the EPA, documenting that enforcement against Federal, State, municipal, and private parties would not be considered at that time.

After completion of the soil excavation in 1985, ground water contamination was expected to attenuate naturally. When arsenic concentrations in the ground water did not significantly decrease, the EPA conducted a second RI from 1992 through 1993. Its purpose was to determine if residual soil contamination remained, the extent and magnitude of ground water contamination, and whether unacceptable risks to human health and the environment existed. In February, 1994, after completing the FS, EPA released a Proposed Plan recommending pumping and treating the arsenic contaminated ground water.

4.0 REMEDIAL ACTIONS

4.1 Remedy Selection

A ROD was signed by EPA on March 31, 1994. The selected remedy included the following major components:

- Institutional controls requiring a Site Deed Restriction;
- Municipal water supply hookup for a nearby resident;
- Installing ground water recovery wells to extract the arsenic contaminated ground water;
- Treatment of the contaminated ground water through a series of treatment units including alumina adsorbers; and,
- Discharging the treated ground water to an infiltration gallery.

The 1994 ROD states the following RA objective:

“The remedial action selected for the site will eliminate the threats associated with ingestion and direct contact with contaminated ground water. The remedial action, in combination with the 1985 remedial action regarding arsenic contaminated soils at the site, should be considered a complete site remedy. When this remedial action is completed, no further remedial action is expected, other than groundwater monitoring. The monitoring of groundwater would be conducted to assure that the arsenic concentration in groundwater remains below the cleanup level.”

4.2 Remedy Implementation

RD activities were initiated in September 1994 and completed in September 1996. The RA construction was initiated during the RD process. Initial RA activities occurred in November and December 1994, when a nearby resident was provided with municipal water and the residential well of concern was abandoned.

According to the EPA 1998 Superfund Preliminary Closeout Report, another RA component was addressed initially in 1983 when the MDH issued a Health Advisory against ground water use from the Site and surrounding area. This report also indicated that restrictions on ground water related to the Site were revised in 1992, prior to ROD approval. The restrictions were not specified.

A Superfund State Contract (SSC) was signed in September 1996 between EPA and the MPCA documenting a 50% cost share of remedial activities. The SSC also explained how the MPCA would contribute to RA activities by providing support during the long-term response phase of the RA. This would involve day-to day monitoring and periodic maintenance of the pump-and-treat system.

Installation of the extraction wells (4 wells and associated piping) occurred in June and July 1997. The location of the extraction wells are shown on Figure 2. The infiltration gallery was installed in September and October 1997. Modifications to retrofit an existing building on-Site, instead of constructing a new treatment building, were conducted in March 1998. Installation of the ground water treatment equipment such as tanks, sand filters, alumina adsorbers, control valves and transfer pumps was initiated in March 1998. Initial system startup began on July 14, 1998. Continual operation of the system began on August 22,

1998. The average flow rate during the period of continual operation was 100 gallons per minute (gpm).

On September 29, 1998, a pre-final inspection of the remedy was conducted by the EPA, MPCA and EPA's contractor. A final inspection was conducted on October 29, 1998, after each of the final punch list items identified in the pre-final inspection were addressed.

4.3 System Operations/Operation and Maintenance (O&M)

EPA contracted with Roy F. Weston, Inc. (Weston), for the design construction of the ground water treatment system. Construction was completed during the summer of 1998.

Following construction Weston operated the treatment system under contract with the EPA for a one year period until transferring the operating system to the MPCA. The MPCA accepted long-term system O&M on July 1, 1999. The MPCA awarded a contract for O&M of the treatment system to Bay West, Inc. (Bay West) under the MPCA Multi-site Superfund Contract. Since that time, Bay West has performed routine and non-routine general equipment operation and maintenance activities at the Site. Bay West is also assisting with the institutional controls, regarding the implementation of a Site Deed Restriction required in the ROD.

4.3.1 Routine System O&M

Bay West performed routine system O&M in accordance with the O&M manual prepared by Weston. The ground water treatment system is composed of three subsystems:

- ground water extraction system;
- pre-treatment system; and
- treatment system.

Each subsystem requires daily and weekly routine maintenance checks to ensure the continued optimum operation.

Ground Water Extraction System. The ground water extraction system includes four extraction wells (EW-1 through EW-4). Routine O&M activities associated with the ground water extraction system included the following:

- Daily monitoring of flows and pressures from each extraction well.
- Daily monitoring of the total system influent and effluent flows.

Pre-Treatment System. The pre-treatment system includes an equalization tank (T-1), a sand filter, and two sludge tanks. The sand filter functions to remove particulate matter prior to treatment. Routine O&M activities associated with the pre-treatment system included the following:

- Daily monitoring of the water level in T-1.
- Daily monitoring of the pressure drop, air flow, valve % open, and regulator pressure for the sand filter.
- As necessary, maintenance for the sand filter including inspection and cleaning of the air lift pump, air fittings, and the head loss measuring tube.
- As necessary, maintenance on the sludge tanks including decanting of the sludge. The decanted water is routed back into the system.

Treatment System. The treatment system included the pH adjustment tank (T-3), the sulfuric acid addition tanks, two activated alumina adsorber vessels, the sodium hydroxide addition tanks and the infiltration gallery. Starting in April 2005, the treatment system was modified so that iron enhanced activated alumina was utilized. This modification has decreased the volume of acid to be used and eliminated the need for the sodium hydroxide addition. Routine O&M activities associated with the treatment system included the following:

- Daily monitoring of the water level and pH in T-3.
- Daily monitoring and filling of the acid and caustic bulk tanks.
- Daily monitoring of the iron activated alumina adsorber vessels for inlet pressure, outlet pressure, and pressure drop.
- Daily monitoring of the feed line to the adsorbers.
- Daily monitoring of the system influent and effluent pH.

General Equipment Maintenance/Activities. Routine maintenance on the system equipment items included the following:

- Weekly checking for wear of the system pumps. The system pumps include the intermediate transfer pumps (P-1 and P-2), four chemical feed pumps, and the sludge pumps.
- Daily observation to ensure proper function of the system control valves, pumps, and motors.
- Monthly calibration of the acid/caustic transfer pumps.
- Weekly observation for leaks or structural fatigue on the system piping and components.
- Monthly checking/cleaning of the sump for solids buildup.
- *As necessary, maintenance for the HVAC system and air compressor.*

The routine system O&M observations were recorded on daily log sheets, summarized on a monthly system O&M summary report and included in annual and biannual reports.

4.3.2 Non-routine System O&M

Non-routine system O&M activities performed during this five year review period included three alumina change-outs, extraction well maintenance, and re-compaction of the parking lot, near the infiltration gallery.

Alumina Change-out. The treatment system utilizes activated alumina to adsorb (remove) arsenic from the ground water. The activated alumina is contained in two pressurized steel vessels in series, consisting of a 'lead' and a 'polishing' vessel. According to the arsenic removal system O&M manual supplied by the manufacturer, the alumina in the lead vessel requires replacement when the effluent from that unit reaches 50% of the influent concentration.

Alumina change-out operations were completed in January 2002, August 2003, and April 2005. As stated above, the spent activated alumina was replaced with iron-enhanced activated alumina during the change-out activities in April 2005. Per the manufacturer and available literature, iron-enhanced activated alumina can adsorb several times more arsenic at a higher pH, therefore the alumina change-out frequency and necessary sulfuric acid to reduce the system influent pH should be decreased. A summary of the change-out

procedure utilized can be found in the annual monitoring reports. The spent alumina was disposed at the Superior FCR Landfill located in Buffalo, Minnesota.

Extraction Well Maintenance Activities. Four extraction wells (EW-1 through EW-4) draw arsenic contaminated ground water into the system at set flow rates. All extraction wells were originally constructed with two 20-foot sections of galvanized steel drop pipe supporting the submersible pump. The galvanized steel drop pipes were replaced with stainless steel due to corrosion caused by electrolysis during the previous review period, except for the top section of drop pipe at EW-2 and EW-3, which were replaced in October 2003.

In December 2005, extraction well pumps in EW1 and EW-2 were not functioning properly and needed repair/replacement. Several months went by before the necessary funds were encumbered to do the required work. As of May 2006, all extraction wells were functioning properly.

4.3.3 Total Operating and Maintenance Costs

The historical project financials for the Site are summarized below. The costs include contract labor, equipment and subcontractors for routine and non-routine maintenance of the treatment system, and utilities. Costs also include sampling of the extraction wells and monitoring well network (see Section 6.0). These costs do not reflect sampling activities performed by the MPCA and analysis performed by the MDH in 2001, or the treatment system building lease (approximately \$28,000 per year for the building lease).

Table 2. Annual System Operations/O&M Costs	
Time Period	O&M Costs (\$)
Interim Phase-In/Out – July 1999	12,862.09
O&M July 1999 through June 2000	124,328.02
O&M July 2000 through June 2001	140,600.83
O&M July 2001 through June 2002	117,547.84
O&M July 2002 through June 2003	140,036.29
O&M July 2003 through June 2004	197,541.43
O&M July 2004 through June 2005	186,888.91
O&M July 2005 through December 2005	62,216.19
Total	1,282,021.60

5.0 PROGRESS SINCE LAST FIVE YEAR REVIEW

This is the second five year review for the Site. The first five year review report was completed and signed on September 25, 2001. Recommendations during the 2001 review included the following:

- The Agencies should determine whether institutional controls are in fact in place. If it is found that they have not been implemented then actions should be taken to ensure that they are implemented to prevent exposure to the contaminated groundwater.

Restrictive Covenants for areas of soil contamination are not currently in place but will be within the next year. The MPCA requested MDH to establish a Special Well Construction Advisory Area for preventing installation of new wells into the plume at the Site in March 1998, prior to the first five year review. The MPCA does not have statutory authority to implement such restrictions. MPCA management is discussing the issue with MDH, as it affects many other site requests. As a result, the MDH has not established the Special Well Construction Advisory Area for this Site. The City of Perham continues to provide municipal water to all residents within the city limits.

6.0 FIVE YEAR REVIEW PROCESS

6.1 Administrative Components

The Site five year review was prepared by Susan Johnson, MPCA Project Manager for the Site. Jeff Gore, EPA Remedial Project Manager for the Site, also assisted with the review. The five year review consisted of the following components:

- Community Involvement
- Document Review
- Data Review
- Site inspection
- Five Year Review Report Development and Review

6.2 Community Notification and Involvement

The completed second five year review report will be available in the Site information repository, and the EPA website for public view. An advertisement notice regarding the five year review process was placed in the Perham Enterprise Bulletin newspaper on July 27, 2006, for public viewing. No public comments regarding the five year review were received.

Community relations are ongoing at the Site. In 2004, the MPCA participated in a series of informational videos, regarding the Site, produced by non-profit interests. The videos were broadcast on the local Perham television station.

6.3 Document Review

This five year review consisted of a review of relevant documentation including O&M records and monitoring data. A list of the documents reviewed is included in Attachment 1.

The Applicable or Relevant and Appropriate Requirements (ARARs) identified in the March 1994 ROD for the Site were also reviewed for changes that could affect protectiveness. A list of the ARARs is included in Attachment 2.

6.4 Data Review

Bay West has performed monthly sampling of the extraction wells and treatment system influent and effluent water at the Site. From March 2001 through June 2002, the MPCA performed the sampling events.

As part of the data review process for this five year review, Bay West summarized all of the analytical reports in tables, generated graphs, and calculated trend lines estimating when the cleanup criteria would be reached in the extraction wells. The tables and graphs will be included in a Ground Water Summary and 2006 Annual O&M Report issued later this year.

6.4.1 Extraction Well Data Summary

Monthly system performance sampling was conducted to measure the system efficiency. Samples were collected from seven sample ports located throughout the treatment system including the four extraction wells, a composite downstream sample, and intermediate sample between the lead and polishing adsorber, and a system effluent sample. Table 3 summarizes the percent reduction of arsenic contamination for each extraction well and the cumulative gallons treated between July 1999 and June 2005.

Table 3. % Reduction of Arsenic Contamination and Cumulative Gallons Treated				
Extraction Well No.	Arsenic Concentrations ($\mu\text{g/L}$)			% Reduction (July 1999 thru June 2005)
	Initial (July 1999)	First Five Year Review (June 2001)	Second Five Year Review (Dec 2005)	
EW-1	86	39	21	76
EW-2	130	47	26	80
EW-3	190	70	35	82
EW-4	290	94	47	84
Cumulative Gallons Treated:	42,115,000	135,345,000	292,651,000	

Currently, all extraction wells are meeting the MCL criteria set forth in the 1994 ROD of 50 $\mu\text{g/L}$ for arsenic, and the plume is contained. The annual volume of ground water treated from January to December 2005 was 44,577,000 gallons.

Treated ground water is injected into an infiltration gallery shown on Figure 2 (up-and side-gradient of the contaminant plume) which is designed to handle a discharge rate of up to 250 gpm. The maximum recorded discharge rate from the system is approximately 111 gpm. Effluent concentrations remain within established parameters before re-injection into the infiltration gallery.

6.4.2 Monitoring Well Network Data Summary

There are 34 monitoring wells that are part of the monitoring well network. In general, the monitoring well network was sampled on a quarterly or semi-annual basis to monitor fluctuations in the ground water elevation and contaminant plume. Three general types of monitoring wells have been installed at the Site; those at the water table (about 20 feet bgs

[designated as shallow]), those approximately 40 ft bgs (intermediate), and others greater than 60 feet bgs (deep). Symbols are used to represent the different well depths.

Ground water at the Site moves in an easterly direction and ultimately discharges into the Otter Tail River, located roughly two miles from the Site. Representative ground water levels from the September 2005 sampling event were used to develop a Site ground water contour map (Figure 3).

The September 2005 data was also used to develop arsenic iso-concentration maps, one shallow (Figure 4), and one intermediate (Figure 5.). Metcalf & Eddy's 1993 analysis of the Site data found that arsenic concentrations increased with depth in ground water as distance increased down-gradient (east) from the Site. Contaminant C concentrations in the aquifer have decreased since the 1993 evaluation and are at lower concentrations at depth when compared to the shallow wells.

Six shallow and intermediate depth wells still exceed the 50 $\mu\text{g/L}$ MCL that was established at the issuance of the ROD. These wells are TCT-1, TCT-1A, TCT-3A, TCT-5, TCT-5A, and MEW-1. Wells MEW-10 and OW-3 have arsenic concentrations between 10 and 50 $\mu\text{g/L}$. The remaining monitoring wells shown in Figure 2 are all below 10 $\mu\text{g/L}$.

In summary, the ground water contamination plume is being contained by the extraction wells and significant reduction in arsenic concentrations has been observed at the outer edges of the plume. The September 2005 analytical results show that arsenic levels in the intermediate wells have generally decreased but some wells have concentrations that are as high as 150 $\mu\text{g/L}$ (TCT-1A).

According to the MDH 1999 health consultation, the ground water plume appears to have moved down-gradient from the original disposal pit in a slug. This observation can still be made when reviewing current data (Figures 4 and 5). However, it also appears that there may be two separate source areas contributing to the groundwater plume as indicated by the two separate areas of arsenic impacts of greater than 50 $\mu\text{g/L}$ shown on Figures 4 and 5.

6.5 Site Inspection

A Site inspection was performed by the MPCA staff and Bay West staff on August 9, 2006. The purpose of the inspection is to assess the protectiveness of the remedy including system operation and access restriction. The operating system and accompanying records were inspected and the system was found to be operating adequately. Updates are needed to the O&M manual to accommodate the new iron alumina media and termination of sodium hydroxide in the system. Extraction well #2 has been temporarily discontinued due to voltage problems. It was later noted that refurbishing the control valves should be completed to reduce repair. Also replacing all the monitoring well sampling tubing is recommended by the contractor.

The site was secure and within the Hammers Construction property (some leased) which is fenced. The excavated arsenic pit is covered by a black topped parking lot minimizing water infiltration and direct soil exposure. The infiltration gallery area has recently been black topped as well. In 2004, settling in the parking lot prompted action to excavate and re-compact the settled area around the east infiltration gallery. The treatment building was in good condition.

6.6 Interviews

The MPCA staff interviewed two individuals for the five year review:

Jim Hammers during the site visit on August 9, 2006; and
Bob Louiseau, Perham City Manager, August 14, 2006.

Mr. Hammers stated he understands the on-going clean up system and believes it is successful. His company currently owns the building where the treatment system is located. However, the front half or west half of the building is being purchased from the Hammers, who are relocating in Perham. Also, through a land swap deal, Hammers was able to buy a strip of land approximately 25 feet wide along the southern property line next to the MN DOT property. The MPCA believe much of the infiltration gallery is encompassed within this strip which is currently used as part of Hammers parking lot.

Mr. Louiseau stated that he and the public works director are part of the Wellhead Protection Committee that is active in local groundwater issues and is current on the Site activities. He thought the system in place was working well for the property use. The arsenic pit area is owned by the City and leased to the Hammers. It is zoned "open space". With any other use for that parcel, it would be rezoned, which there are no current plans land use change. The Hammers and MN DOT property is currently zoned commercial. Overall, the property adjacent to State Highway 78, western property line near the pit area, is valuable and could be targeted for further commercial development in the future. All water users in the city limits are supplied by the municipal wells.

7.0 TECHNICAL ASSESSMENT

7.1 Question A: Is the remedy functioning as intended by the decision documents?

Implementation of Institutional Controls and Other Measures:

Institutional Controls (ICs) are non-engineered instruments, such as administrative and legal controls that help to minimize the potential to exposure to contamination and that protect the integrity of the remedy. ICs are required to assure long-term protectiveness for any areas which do not allow for unlimited use or unrestricted exposure. ICs are also required to maintain the integrity of the remedy.

The MPCA is implementing and monitoring institutional controls at the Perham Arsenic Site. At the initiation of the RA activities, all potential users were hooked up to the municipal water supply. Site institutional controls through deed restrictions to all property owners affected by Site contamination will be put in place within the next year.

The MPCA sent a request for establishing a Special Well Construction Area to the MDH Well Management Section on March 3, 1998. By establishing a Special Well Construction Area, new wells could not be drilled into or through the contaminated aquifer without the approval of the MPCA and the MDH. The Special Well Construction Area has not been established to date.

RA Performance: The arsenic containment and treatment system has been effective in containing the contaminant plume (Figure 4) and removing arsenic from the ground water (Table 3, Section 6.4.1). In addition, some minor system repairs have been needed but the

performance of the treatment system has not been reduced. The treatment system is meeting the established parameters prior to re-injection and an inward plume gradient has been established. These factors indicate that the RA continues to be effective and that the arsenic treatment system continues to be operating and functioning as designed.

Cost of System Operations/O&M: Costs for system operations and O&M are summarized in Table 2 (Section 4.3.3). The 1994 ROD estimated annual O&M costs at approximately \$217,000. The costs associated with the O&M are below the estimated amount and therefore, are within an acceptable range.

Opportunities for Optimization: As stated in Section 4.3.2, during the change-out activities in April 2005, the spent activated alumina was replaced with iron-enhanced activated alumina. Iron-enhanced activated alumina can adsorb several times more arsenic at a higher pH. Therefore the alumina change-out frequency was decreased, thereby optimizing the current system. In addition, sodium hydroxide treatment has been eliminated as a pH adjustment step.

Given the adequate performance of the arsenic treatment system, this five-year review did not identify a need for additional optimization of the system at this time. However, it appears that the infiltration galleries are not being used to their full potential and the system could be evaluated to determine if the pumping rates of the extraction wells could be increased and whether the pretreatment and treatment system could handle greater flow rates. If flow rates could be increased, remediation time could be decreased and overall remediation costs could be reduced.

In addition, based on the ground water analytical results, residual soil contamination and/or additional source areas may exist. Optimization possibilities for decreasing the site cleanup time, effort, and money include new technologies not available at the time of the 1994 ROD. Examples include an iron filings blanket or iron filings injection, among others. These technologies could be used in conjunction with the current remedy. Optimization will be further explored in the 2006 Annual Report.

Early Indicators of Potential Remedy Failure: No early indicators of potential remedy failure were noted during the review. Maintenance activities have been consistent with expectations.

7.2 Question B: Are the assumptions used at the time of remedy selection still valid?

Changes in Standards and To Be Considered:

Ground Water: Safe Drinking Water Act, 40 CFR 41, MCLs. The MCL for arsenic at the time of the ROD was 50 ppb. This standard was set by EPA in 1975, based on a Public Health Service standard originally established in 1942. A March 1999 report by the National Academy of Sciences concluded that the current standard does not achieve EPA's goal of protecting public health and should be lowered as soon as possible. On January 22, 2001, a new arsenic rule was promulgated and EPA set a new arsenic standard for drinking water at 10 ppb to protect consumers against the effects of long-term, chronic exposure to arsenic in drinking water. The MCL for arsenic is applicable for residential drinking water.

Soil: At the time of the 1994 ROD, procedures for determining risk-based soil cleanup values based on human dermal, inhalation, and ingestion exposure and for determining soil leaching to ground water were being developed at the State level. At present, there are revisions to the “To Be Considered” (TBC) cleanup levels.

a. Direct Contact: In 1998, the MPCA developed the Soil Reference Values (SRVs). A SRV is a soil concentration which corresponds to a specified target risk level based on a specific exposure scenario. A SRV is used as a decision criterion in assessing potential human health concern at contaminated sites through the exposure routes of ingestion, inhalation and dermal contact. The 1994 ROD lists the soil cleanup level as 500 ppm for arsenic. Currently, the new SRVs for arsenic are 10 milligrams per kilogram (mg/kg) for industrial land use and 70 mg/kg for the short-term worker exposure in an industrial setting. The industrial and short-term worker SRVs for lead both are 700 mg/kg. These current numbers were presented in a September 20, 2005, memorandum from Laura Solem, MPCA toxicologist, to the MPCA staff. Additional information on the development of the SRVs can be found in the “Risk-Based Guidance for the Soil – Human Health Pathway” at the MPCA website <http://www.pca.state.mn.us/cleanup/riskbasedoc.html>.

b. Leaching: In addition to human exposure through direct contact, the procedures for generating site-specific soil leaching numbers to protect against continued leaching to ground water, as required in Minn. Rule 7060.0600, subp. 1 through 3, are documented within the “Risk-based Guidance for Evaluating the Soil Leaching Pathway” also found at the MPCA website <http://www.pca.state.mn.us/cleanup/riskbasedoc.html>. The Tier 1 screening numbers for arsenic and lead, which are 15.1 mg/kg and 525 mg/kg, respectively. The Tier 2 site specific cleanup numbers would need to be generated based on Site specific characteristics and data using the procedure provided for in this document.

Changes in Exposure Pathways: No changes in the Site conditions that affect exposure pathways were identified as part of the five year review. There are no current or known planned changes in the Site land use. In addition, no new contaminants, sources, or routes of exposure were identified as part of this five year review.

Changes in Risk Assessment Methodologies: Changes in risk assessment methodologies since the time of the ROD do not call into question the protectiveness of the remedy.

7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information has been identified that would call into question the protectiveness of the remedy. A Site Deed Restriction required in the ROD still needs to be implemented.

8.0 ISSUES

Issues that were discovered during the five-year review process and the Site inspection are noted in Table 4.

The Site Deed restriction required in the ROD needs to be implemented and effective for the remedy to be protective in the long-term.

Table 4. Issues		
Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Institutional Controls including Site Deed Restriction document required by the ROD have not been implemented.	N	Y

Y=yes; N=no

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow-up actions for issues that were discovered during the five year review process and the Site inspection are noted in Table 5.

A Site Deed restriction document including property boundaries shall be implemented by September 2007.

Table 5. Recommendations and Follow-up Actions						
Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness(Y/N)	
					Current	Future
Institutional Controls required by the ROD have not been implemented.	Establish Institutional Controls including Site Deed Restriction document	MPCA	MPCA	September 2007	N	Y

Y=yes; N=no

10.0 PROTECTIVENESS STATEMENT(S)

The remedy at the Site is currently protective of human health and the environment. There is no evidence of current exposure to arsenic contaminated soil or groundwater. However, to ensure long-term protectiveness institutional controls restricting well drilling and soil exposure must be put in place. A Site Deed Restriction required by the ROD is currently in the process of being implemented by MPCA with schedule for completion in one year.

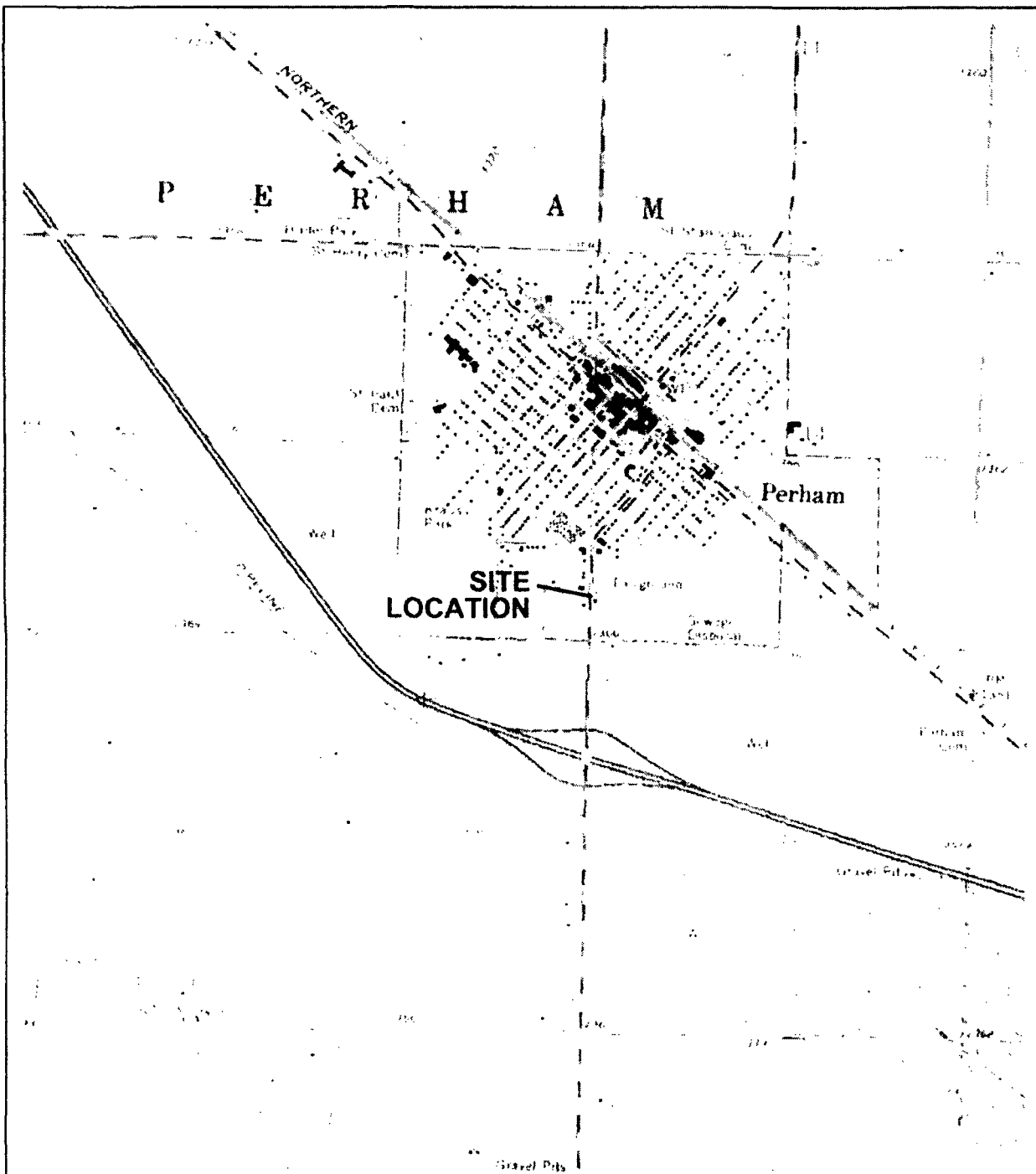
Long-term protectiveness of the remedy will be assured by continuing the long-term Operation and Maintenance (O&M) of the treatment system, by continuing long term monitoring to assure plume capture, and by implementing and maintaining effective institutional controls as well as the Site remedy components.

11.0 NEXT REVIEW

This is a statutory Site that requires ongoing five year reviews. The next review will be conducted by September 25, 2011.

12.0 OTHER COMMENTS


The activities at this Site will be maintained by the MPCA until further notice.

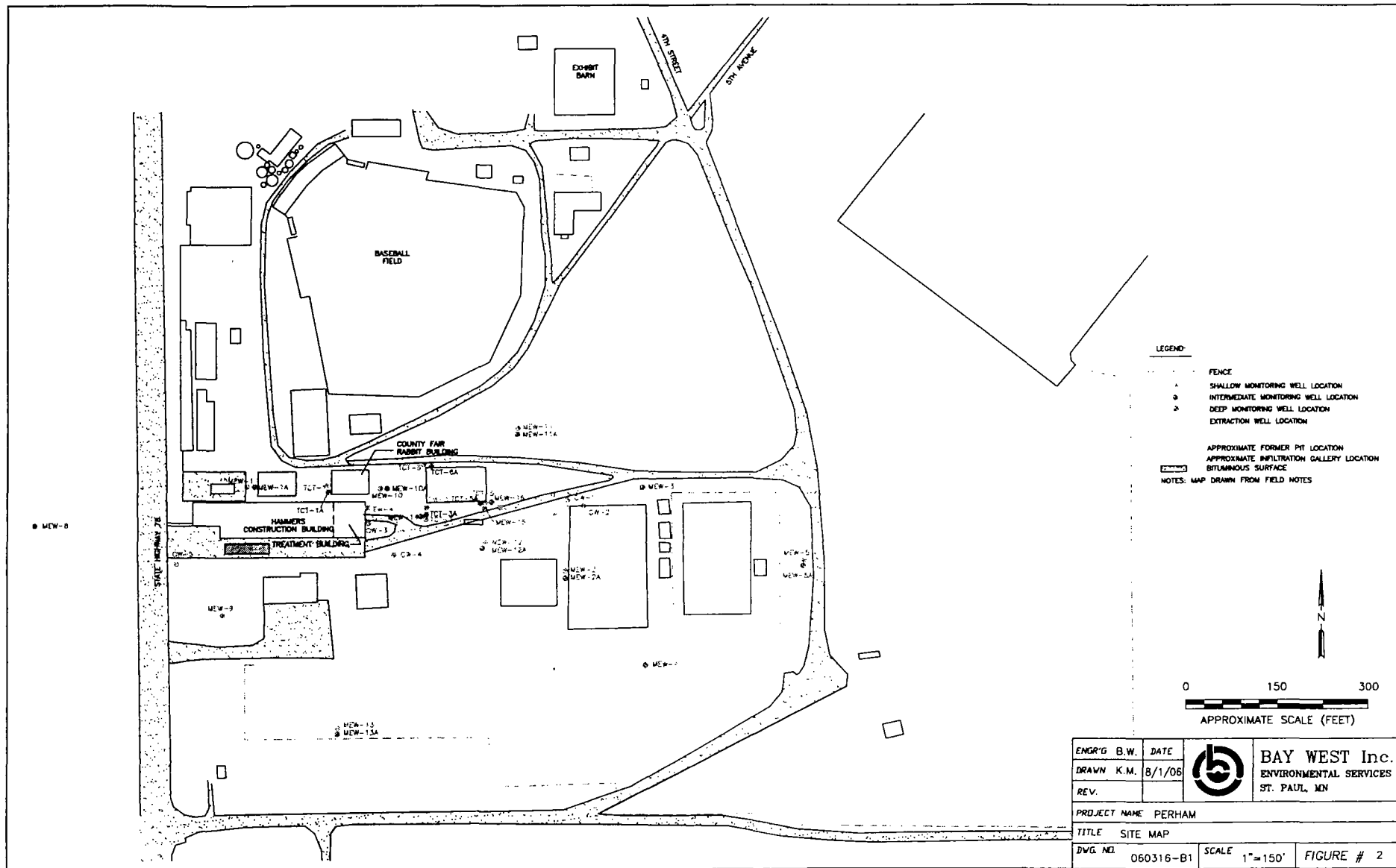


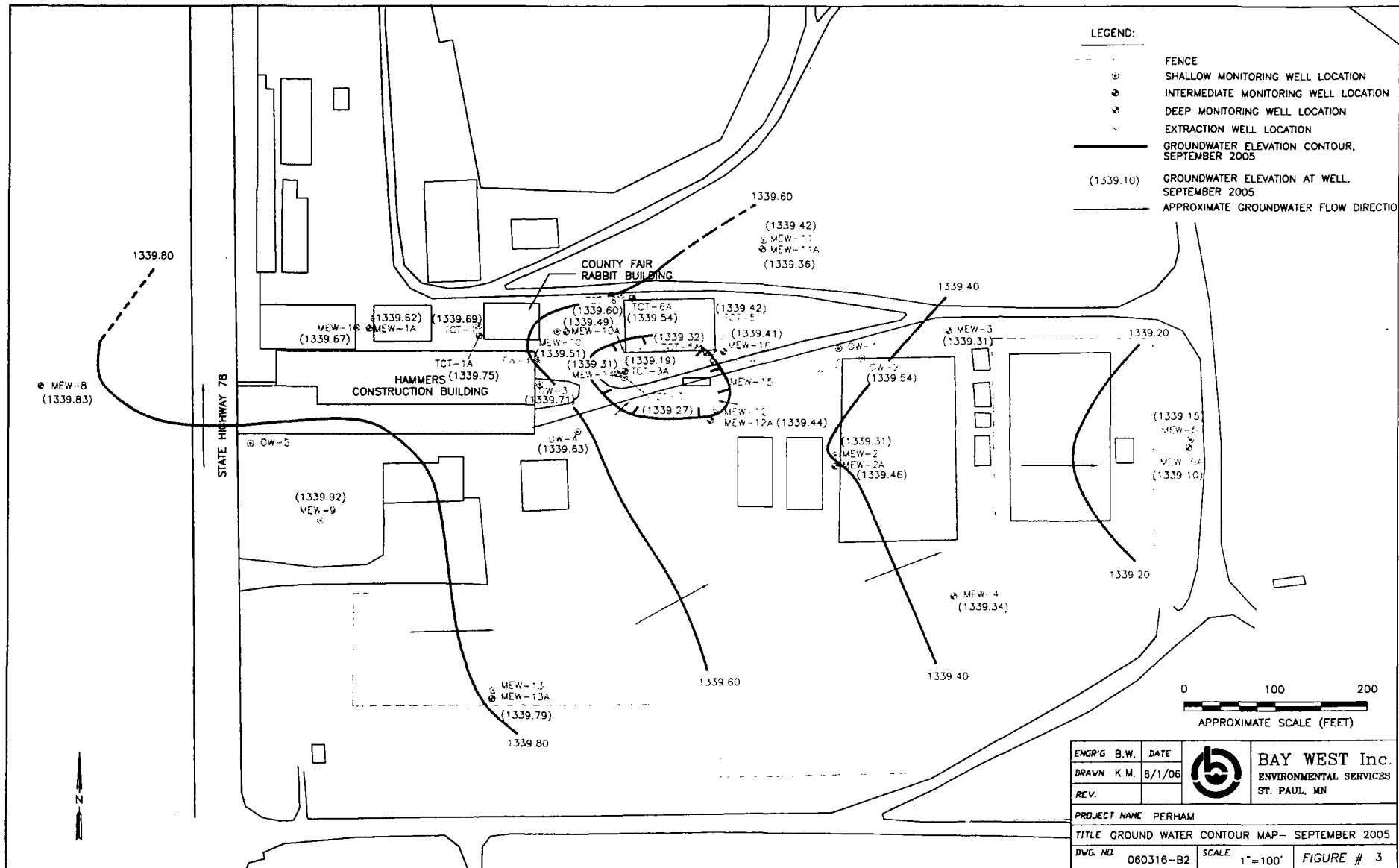
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 APPROXIMATE SCALE (FEET)

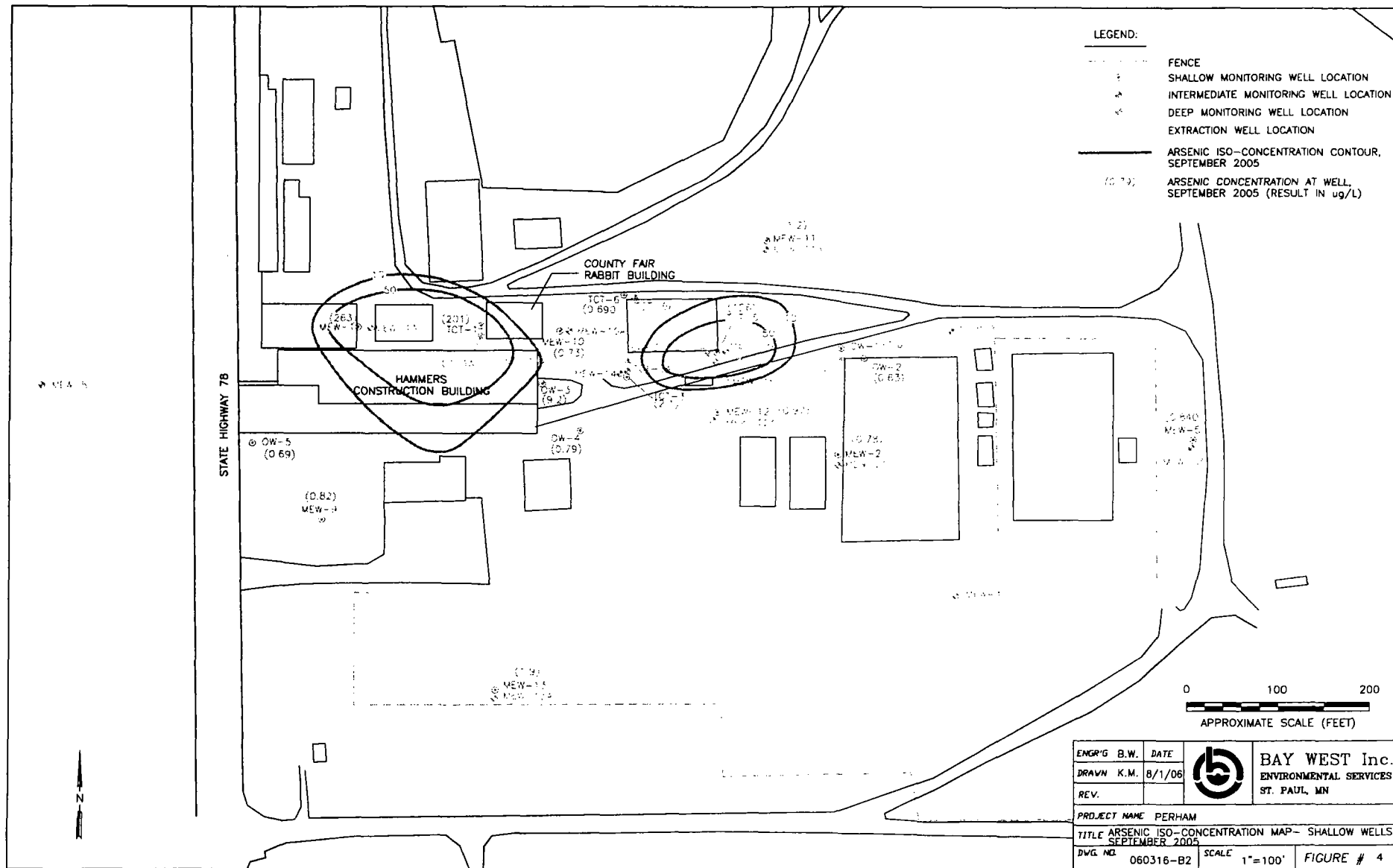
SOURCE:
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 TOPOGRAPHIC MAP--
 PERHAM, MN
 QUADRANGLE

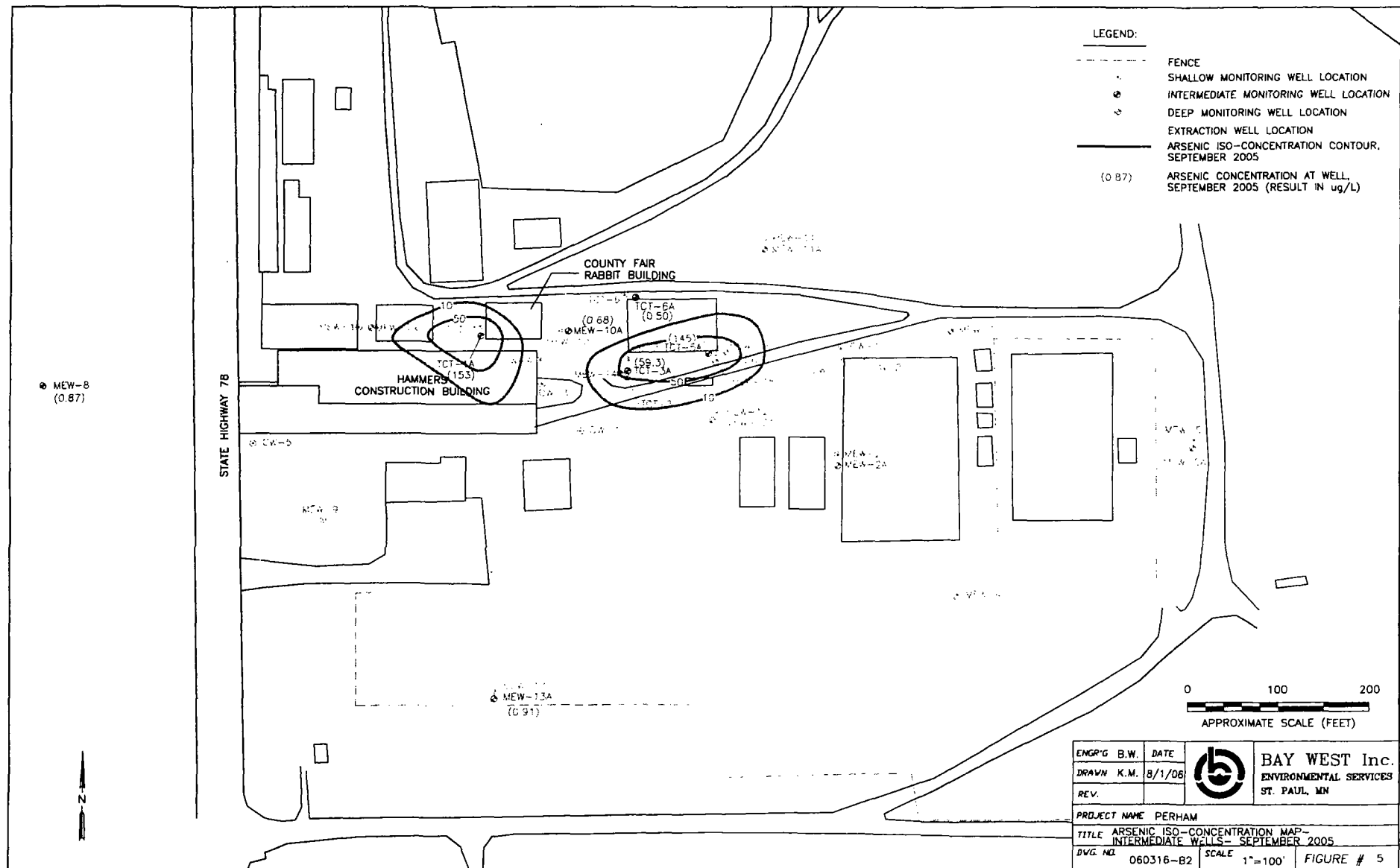


ENGR'G	E.B.	DATE		BAY WEST Inc. ENVIRONMENTAL SERVICES ST. PAUL, MN
DRAWN	K.M.	8/2/06		
REV.				
PROJECT NAME PERHAM				
TITLE SITE LOCATION MAP				
DWG. NO.	060316-A1	SCALE	1"=2000'	FIGURE # 1









Attachment 1

List of Documents Reviewed

Documents reviewed in preparation of this five year review report include the following:

- Final Remedial Investigation Report, Perham Arsenic Burial Site, Perham, Minnesota, Metcalf & Eddy, November 1993.
- Record of Decision, Perham Arsenic Burial Site, Perham, Minnesota, U.S. EPA, March 31, 1994.
- Preliminary Draft, Final Report Perham Arsenic Burial Site Remedial Investigation, Perham, Minnesota, Twin City Testing and Engineering Laboratory, Inc. June 30, 1984.
- Preliminary Remedial Design Report, Perham Arsenic Burial Site, Perham, Minnesota, Weston, June 1996.
- State of Minnesota Office Memorandum, Perham Arsenic Site Remedy, September 25, 1996.
- State of Minnesota Office Memorandum, Request for Special Well Construction Area, Perham Arsenic Site, March 3, 1998.
- Superfund Preliminary Closeout Report, Perham Arsenic Burial Site, Perham, Minnesota, U.S. EPA, September 29, 1998.
- Health Consultation, Perham Arsenic Site, Perham, Ottertail County, Minnesota, Minnesota Department of Health in Cooperative Agreement with the Agency for Toxic Substances and Disease Registry, February 1999.
- U.S. EPA Office of Solid Waste and Emergency Response (OSWER) *Comprehensive Five-Year Review Guidance* directive No. 9355.7-03B-P, June 2001.
- Treatment System Operation & Maintenance Annual Summary Report, Fiscal Year 2001, September 2001.
- First Five-Year Review Report, Perham Arsenic Burial Site, Perham Minnesota, September 2001.
- Treatment System Operation & Maintenance Bi-Annual Summary Report, Fiscal Years 2002 and 2003, April 2004.
- Treatment System Operation & Maintenance Bi-Annual Summary Report, Fiscal Years 2004 and 2005, March 2006.
- Quarterly Analytical Reports.
- Field Sampling Data Sheets.
- Safe Drinking Water Act, 40 CFR 41.

Attachment 2

ARARs

Excerpt From March 1994 Record of Decision

The selected remedy complies with all applicable or relevant and appropriate requirements (ARARs), as required by CERCLA Section 121(d)(2), 42 U.S.C. § 9621(d)(2). ARARs identified for the site are as follows:

a. Chemical Specific

Safe Drinking Water Act Maximum Contaminant Levels (MCLs) for Arsenic (applicable)

Resource Conservation and Recovery Act Identification and Listing of Hazardous Wastes, 40 C.F.R. Part 261 (applicable)

b. Location Specific

(none)

c. Action Specific

Minn. Rule 7060.0660-900 [prohibition on waste filtration galleries, and variance from the prohibition where necessary to protect public health, safety or welfare, or where strict conformity with the prohibition would be unreasonable]. (applicable)

Resource Conservation and Recovery Act Generator Standards, 40 C.F.R. Part 262 (applicable)

Resource Conservation and Recovery Act Transporter Standards, 40 C.F.R. Part 263 (applicable)

While not ARARs because the contemplated activity will occur off-site, it is noted that it may be necessary to ensure that residual wastes from the treatment process are disposed of at a hazardous waste facility that complies with RCRA Subtitle C requirements and, if the pertinent standard for arsenic is exceeded, RCRA land disposal restrictions (LDRs), 40 C.F.R. Part 268, because these wastes may contain arsenic in concentrations prompting such protectiveness.



**EPA Reviews
Perham Arsenic
Superfund site
Perham, Minnesota**

U.S. Environmental Protection Agency is reviewing the effectiveness of the cleanup at Perham Arsenic Superfund site in Perham. Superfund law requires five-year reviews of sites where the cleanup is either done or in progress but hazardous waste remains on-site. These five-year reviews are done to ensure that the cleanup remains effective and protects human health and the environment. This is the second five-year review for this site.

The first five year review was completed in 2001 and addressed overall site conditions. The report concluded that the cleanup actions at the site were protective of human health and the environment

Site contamination in both the ground water and soils is arsenic. Potential Health threats include ingesting or coming in direct contact with contaminated ground or soil. A clay cover was put over the site, soils were excavated, and a pump and treat system for the contaminated ground water was installed. Deed restrictions against digging wells and using the groundwater were begun and city water was extended to the site.

The review looks at:

- site information
- how the cleanup was done
- how well the cleanup is working
- any future actions needed

Site records are in the Region 5 Records Center, room 711, 77 West Jackson Boulevard, Chicago, IL. The center is open Monday through Friday 8:00 a.m. to 4:00 p.m. Contact Janet Pfundheller, Records Manager (312) 353-5821 or Linda Ross, Assistant Records Manager (312) 353-6626 for details or further assistance. Site information can also be found locally at:

Perham City Library
225 2nd Avenue, NE
Perham, MN

Questions or concerns regarding the cleanup or the review should be directed to:

Maureen K. Johnson
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Superfund & Emergency Response Section
Remediation Division
Minnesota Pollution Control Agency
520 Lafayette Road North
St Paul, MI 55155
(651) 296-9707
Maureen.johnson@state.mn